

CLAIMS

- 1 1. An optical system comprising:
 - 2 a substrate;
 - 3 a first optoelectronic element supported by the substrate;
 - 4 a first channel formed in the substrate; and
 - 5 a first heat transfer fluid arranged in the first channel, the first heat transfer
 - 6 fluid being thermally coupled with the first optoelectronic element such that at least a
 - 7 quantity of heat produced by the first optoelectronic element is dissipated by the first
 - 8 heat transfer fluid.

- 1 2. The optical system of claim 1, further comprising:
 - 2 a second optoelectronic element supported by the substrate; and
 - 3 wherein the first heat transfer fluid optically communicates with the first
 - 4 optoelectronic element and the second optoelectronic element such that the first heat
 - 5 transfer fluid can propagate optical signals between the first optoelectronic element
 - 6 and the second optoelectronic element.

1 3. The optical system of claim 2, further comprising:
2 a second channel formed in the substrate; and
3 a second heat transfer fluid arranged in the second channel, the second heat
4 transfer fluid being thermally coupled with the first optoelectronic element such that
5 at least a quantity of heat produced by the first optoelectronic element is dissipated by
6 the second heat transfer fluid.

1 4. The optical system of claim 3, wherein the first heat transfer fluid is different
2 than the second heat transfer fluid.

1 5. The optical system of claim 3, wherein the second heat transfer fluid optically
2 communicates with at least one of the first optoelectronic element and the second
3 optoelectronic element.

1 6. The optical system of claim 5, wherein the second optoelectronic element and
2 the first optoelectronic element are operative to communicate with each other
3 optically via the second heat transfer fluid.

1 7. The optical system of claim 6, further comprising:
2 first and second reflectors arranged in the first channel for directing optical
3 signals between the first and second optoelectronic elements.

1 8. The optical system of claim 6, wherein the portion of the substrate that defines
2 the first channel exhibits a refractive index lower than a refractive index of the first
3 heat transfer fluid such that the first channel operates as a waveguide for directing
4 optical signals between the first and second optoelectronic elements.

1 9. The optical system of claim 6, wherein the substrate is substantially planar and
2 has an exterior surface;

3 wherein the first channel is substantially U-shaped, with first and second ends
4 of the first channel terminating at the exterior surface of the substrate; and

5 wherein the first optoelectronic element optically couples with the first end of
6 the first channel and the second optoelectronic element optically couples with the
7 second end of the first channel .

1 10. The optical system of claim 9, further comprising:

2 a first reflector arranged in the first channel and optically communicating with
3 the first optoelectronic element; and

4 a second reflector arranged in the first channel and optically communicating
5 with the second optoelectronic element, the first and second reflectors optically
6 communicating with each other such that an optical signal propagated from the first
7 optoelectronic element is reflected from the first reflector to the second reflector and
8 directed to the second optoelectronic element.

1 11. The optical system of claim 1, wherein the first heat transfer fluid is contained
2 within the substrate.

1 12. The optical system of claim 1, wherein the first heat transfer fluid is a liquid.

1 13. The optical system of claim 1, further comprising:
2 a recirculator fluidly communicating with the first heat transfer fluid, the
3 recirculator being operative to move the first heat transfer fluid within the first
4 channel.

1 14. The optical system of claim 13, further comprising:
2 means for removing heat from the first heat transfer fluid.

1 15. The optical system of claim 13, further comprising:
2 a heat exchanger fluidly communicating with the first heat transfer fluid, the
3 heat exchanger being operative to remove heat from the first heat transfer fluid.

1 16. The optical system of claim 1, further comprising:
2 an input transmission medium optically communicating with the first heat
3 transfer fluid; and
4 an output transmission medium optically communicating with the first heat
5 transfer fluid.

1 17. A method for cooling an optoelectronic element supported by a substrate, said
2 method comprising:
3 providing a heat transfer fluid; and
4 channeling the heat transfer fluid in the substrate to thermally couple with the
5 optoelectronic element such that at least a quantity of heat produced by the
6 optoelectronic element is dissipated via the heat transfer fluid.

1 18. The method of claim 17, further comprising:
2 propagating an optical signal through the heat transfer fluid.

1 19. The method of claim 17, further comprising:
2 directing the heat transfer fluid away from the optoelectronic element;
3 cooling the heat transfer fluid; and
4 directing the heat transfer fluid toward the optoelectronic element.

1 20. The method of claim 17, wherein the optoelectronic element is a first
2 optoelectronic element; and
3 further comprising:
4 providing a second optoelectronic element supported by the substrate; and
5 propagating an optical signal through the heat transfer fluid from the first
6 optoelectronic element to the second optoelectronic element.